USEFUL RELATIONSHIPS BETWEEN K_{eff}, B_m^2 and B_g^2

The reactivity of a fissile system can be described by

$$k_{eff} = \frac{k_\infty}{1 + M^2 B_g^2}$$

where

k_{eff} = effective multiplication constant

k_∞ = multiplication constant for an infinite amount of the fissile material

B^2 = geometrical buckling of the system

M^2 = migration area of the neutrons (about 25 to 30 cm for H/fissile atom $\geq$20)

at critical $k_{eff} = 1.0$ and $B_m^2 = B_g^2$, where

B_m^2 = material buckling of the fissile material, or

$$1 = \frac{k_\infty}{1 + M^2 B_m^2}$$

Substituting, we have:

$$k_{eff} = \frac{1 + M^2 B_m^2}{1 + M^2 B_g^2}$$

and we can determine the reactivity of a given system with a known geometry and material, or

$$B_m^2 = \frac{k_{eff}(1 + M^2 B_g^2) - 1}{M^2}$$

where the geometry and the limiting k_{eff} is known and the material buckling is desired, or

$$B_g^2 = \frac{1}{M^2}\left[\frac{1 + M^2 B_m^2}{k_{eff}} - 1\right]$$

where the limiting k_{eff} and the material is known and the limiting geometry is desired.

These equations may be used for rough determinations of the desired parameters for simple geometrical shapes with no interaction.